CHAPTER 3: EXISTING CONDITIONS IN THE WATERSHEDS

Otay and Dulzura Watersheds

Water Sources **-**

Lower Otay Reservoir is important to the region for its supply from the SDCWA Aqueduct System carrying Colorado River and State Project water to the San Diego area. The primary function of the reservoir is to store imported water, local runoff water from the surrounding 111 square-mile watershed, and water transferred from Barrett and Morena Reservoirs, located in the Cottonwood Watershed via the Dulzura Conduit (Figure 3-3.1). The reservoir and associated facilities are owned and operated by the City of San Diego.

The management of the water supply system typically attempts to restrict the purchase of imported water and regulates the reservoir levels to maximize the use of local water. Under all conditions, an emergency supply is maintained within the reservoir should a failure occur to the imported water supply system. Because of this, the City does not typically draft a significant amount of water from Lower Otay Reservoir, in an effort to reserve the majority of the impounded water for emergency storage.

All of the facilities associated with the conveyance of water from the Otay/Dulzura Watershed to the public are mainly natural watercourses which lie in the rural and remote portions of the watershed. These natural conveyances are not likely to fail due to age and deterioration. Some problems may be encountered in the pumping process between Lower Otay Reservoir and the Otay Water Treatment Plant. Since the pumping process is localized, any problems which may occur can be prevented through regular maintenance.

Raw Water Reservoirs -

Upper Otay Reservoir Dam is a thin, flat concrete arch, reinforced with wire rope and steel plates. The dam was reduced in size by a trapezoidal notch measuring 30 feet at the base and 160 feet at the top. The spillway capacity is 10,500 cfs. The dam crest has a length of 350 feet and stands approximately 68 feet above the streambed. From a seismic analysis of the dam, completed by the California State Division of Safety Dams (DSOD), a mandate was issued requiring the maximum storage level to be lowered. The mandate reduced the capacity from 2,830 acre-feet to 800 acre-feet.

Lower Otay Reservoir's Savage Dam, is a curved cyclopean concrete gravity structure. It has a 225-foot-wide over pour spillway and a 201-foot-wide independent spillway section. The combined spillway capacity is 49,400 cubic feet per second (cfs). The dam crest has a length of 741 feet and stands roughly 145 feet above the streambed. The reservoir has a storage capacity of 49,510 acre-feet and a surface area of 1,110 acres at spillway crest at 484 feet MSL.

Raw Water Intake and Conveyance Facilities -

Upper Otay Reservoir outlet consists of one low-level 16-inch conduit through the dam. Water is released with a maximum draft rate of 34 cfs (22 mgd). The water which freely flows over the notch is collected downstream into Lower Otay Reservoir.

Lower Otay Reservoir outlet consists of an independent wet tower, west of the dam face, with seven 30-inch saucer valves for selective level draft control. Water is released from the tower through a 48-inch outlet pipe located at the dam. The 48-inch pipeline has a maximum draft rate to the treatment plant of 74 cfs (48 mgd) and to the blow off and treatment plant of 349 cfs (225 mgd).

Treated Water Facilities -

All treatment facilities and treated water facilities for Lower Otay Reservoir occur at and beyond the Otay Water Treatment Plant. The plant is located adjacent to Lower Otay Reservoir and serves the South Bay area of the City. The Plant treats imported water and local runoff from the Otay/Dulzura and Cottonwood watersheds. The Otay Water Treatment Plant is of conventional design with flocculation, filtration, disinfection (chloramines) and has a 40 mgd capacity. The plant is designed and operated in compliance with California's Chapter 17: Surface Water Filtration and Disinfection Treatment Regulations.

Cottonwood Watershed

Water Sources -

The primary function of Barrett and Morena Reservoirs is to store local runoff water from the surrounding 241 square miles. Morena Reservoir collects surface runoff from the northern and eastern portions of the watershed. The water released from Morena Reservoir transfers naturally via Cottonwood Creek to Barrett Reservoir. Barrett Reservoir stores water transferred from Morena Reservoir and runoff from the remaining areas of the watershed. Downstream of the Barrett Dam, the Dulzura Conduit transports the water to Upper Dulzura Creek in the Otay Watershed, which flows to Lower Otay Reservoir and ultimately the Otay Treatment Plant (Figure 3-3.1). The reservoirs and associated facilities are owned and operated by the City of San Diego.

Both reservoirs lack the ability to provide emergency supply storage for the City due to their eastern locations, high elevations, and lack of connections to imported water aqueducts. Morena Reservoir is considered an inefficient reservoir due to its high evaporative losses. Since the evaporative losses are so great, the water from Morena Reservoir is transferred to Barrett Reservoir,

provided storage capacity is available. The management of the water supply system utilizes the reservoir levels to maximize the use of local raw water. The City drafts a significant amount of water from Morena and Barrett Reservoirs, in an effort to collect the local water for storage.

Raw Water Reservoirs -

Morena Dam is a rock-fill embankment with an impervious upstream face consisting of rubble masonry and concrete with an un-gated spill crest length of approximately 312 feet. The spillway capacity is 25,000 cubic feet per second (cfs). The dam crest has a length of 550 feet and stands roughly 171 feet above the streambed. The reservoir has a storage capacity of 50,206 acre-feet and a surface area of 1,541 acres at spillway crest at 3,039 feet MSL.

Barrett Dam is a single curve gravity structure, with 26 spillway crest openings which are 13 feet each in length, and a total spillway clear length of 336 feet. The dam crest has a length of 746 feet and stands approximately 171 feet above the streambed. The reservoir has a storage capacity of 37,947 acre-feet and a surface area of 811 acres at a spillway crest of 1,607 feet MSL.

Raw Water Intake and Conveyance Facilities -

Morena Reservoir outlet consists of an independent, cylindrical reinforced concrete dry tower roughly, 100 feet from the face of the dam with three 24-inch sluice gate valves for selective level draft control. Water is released from the tower to a 30-inch vertical pipe, then to an eight-foot-high inverted U-shaped outlet tunnel through solid granite in the left abutment of the dam. The tunnel ends downstream of the reservoir to Cottonwood Creek where the water travels to Barrett Reservoir. Morena Reservoir outlet has a maximum draft rate of 300 cfs (194 mgd).

Barrett Reservoir outlet consists of an independent dry tower with three 30-inch saucer valves on the outside and 30-inch valves on the inside for selective level draft control. Water is released from the tower to a 30-inch conduit which passes through a tunnel in the right abutment of the dam and discharges to the Dulzura Conduit. Barrett Reservoir outlet has a maximum draft rate of 272 (175 mgd). The Dulzura Conduit empties through a gravity process into Upper Dulzura Creek and ultimately into Lower Otay Reservoir. The gravity-powered Dulzura Conduit has the ability to transport 40 mgd. Restorations to the Dulzura Conduit were completed in 1995. In 2004, the area received extraordinarily high rainfall which damaged the conduit; therefore, the conduit is currently unusable. Completion date for repair is unknown.

Treated Water Facilities -

All treatment facilities and treated water facilities for the Cottonwood Watershed occur at and beyond the Otay Water Treatment Plant.

Emergency Plans –

There are no written emergency plans addressing accidental or intentional disposal of contaminants to the raw water supply system for the City. However, the City does have the following two procedures which are understood policies, should an emergency occur relating to water quality:

- If a treatment plant cannot treat the water to an approved health standard level, due to upstream contaminants or treatment plant failures, the treatment plant shall be shut down. Treated water shall then be re-directed to the downed service area through the distribution system from other treatment plants.

- If any emergency exists, the City has a chain of communication procedure for notification of City staff.

Natural Settings

Slope -

Slope is recognized as a critical factor in soil slips/landslides. In Southern California a direct relationship exists between frequency of soil slips and slope. USGS estimates that 70% of soil slips originate in slopes between 20° and 36°.These soil slips have the potential to increase sedimentation in streams and reservoirs.

Water falling on steeply-sloped land runs off with greater velocity and infiltrates less than water falling on flat land. This response leads to increased erosion and limits the soils natural ability to absorb contaminants. Information on slope was derived from a digital elevation model provided by San Diego Data Processing Corporation and United States Geological Survey (USGS).

Otay & Dulzura Watersheds:

No changes in slope have occurred since 2000 (Figure 3-3.2, Table 3-3.3).

Table 3-3.2
Otay and Dulzura Watersheds Slope

Slope	Acres	Percent
0 - 15°	29752.72	41.32
16 - 25°	14505.63	20.15
26 - 50°	22554.51	31.32
> 50°	5190.16	7.21
Total	72003.02	100.00

Cottonwood Watershed:

No changes in slope have occurred since 2000 (Figure 3-3.3, Table 3-3.2).

Table 3-3.3 Cottonwood Watershed Slope		
Slope	**Acres**	**Percent**
0 - 15°	31595.74	19.40
16 - 25°	77167.40	47.37
26 - 50°	40551.09	24.89
> 50°	13583.33	8.34
Total	162897.57	100.00

Soils

Most of the soils within the watershed are susceptible to erosion. The erosion of these soils is mitigated through the anchoring affect of natural vegetation (see Vegetation). Impacts to the vegetation through fire, development or other means could cause increased erosion and impact surface water quality (see Fires, Land Use, Rainfall and Runoff).

Otay/Dulzura Watershed:

Due to the Otay Mountain fire (see Fires) of 2003 the surface soils in the burn areas of Otay/Dulzura Watershed had become temporarily hydrophobic. This condition, combined with loss of natural vegetation, can cause increased erosion. Aside from large areas of exposed bedrock, soils within the Otay Watershed are predominantly well drained loams. Friant fine sandy loam, San Miguel-Exchequer rocky silt loam and Cienenba coarse sandy loam are the dominant soil types within the watershed (Figure 3-3.4). A large portion of the Dulzura Watershed consists of acid igneous rock land (Figure 3-3.4). In addition Cieneba coarse sandy loam, Las Posas fine sandy loam and Friant fine sandy loam are well represented within the watershed.

Cottonwood Watershed

Aside from large areas of exposed bedrock, soils within the Cottonwood Watershed are predominantly well drained sandy loams. Sheephead rock

fine sandy loam, La Posta loamy coarse sand and Bancas stony loam are the most widespread soil types within the watershed (Figure 3-3.5)

Vegetation

Vegetation cover provides several ecological services pertinent to water quality. The root systems of plants anchor soil that could otherwise erode into streams and reservoirs (see Soils). Wetlands and other riparian plant communities act as natural filters, removing suspended sediments and contaminants. Sediments are trapped by densely growing wetland plants, and many contaminants are absorbed or chemically altered by the vegetation.

The description of the different plant communities found in the watershed (Sawer and Keeler-Wolf classification, 1995) and their respective response to fire is from the 2003 Southern California Fires Burned Area Emergency Stabilization and Rehabilitation Plan prepared by the Interagency Burned Area Emergency Response Team November, 2003. The maps of vegetation communities (Figures 3-3.6, 3-3.7; Tables 3-3.4, 3-3.5) have been updated using current SanGIS data.

Oak Woodlands

Vegetation Types:

Oak woodlands typically occur in the foothills and transition into mixed conifer/oak woodlands at higher elevations. Each community type can vary from open savannas in broad valleys and rolling hills to dense woodlands in canyons and along streams. Oak woodlands are dominated by live oak trees species that include Black Oak, Coast Live Oak, Engelmann Oak, and Canyon Live Oak.

Response to Fire:

Oak woodlands have evolved with fire. Dense woodlands typically experience low frequency stand destroying fires. Oak trees that experience some canopy fire often survive unless the ground fire temperature is extreme enough to kill

the root system. The complex of species associated with dense oak woodlands will either re-sprout or germinate from seed. Frequent or hot fires can affect the seed bank and the root system of Oak Woodland species resulting in degraded habitat that is susceptible to habitat conversion.

Eucalyptus Woodland

Vegetation Types:

Eucalyptus Woodland is a non-native closed canopy community. This community is typically a monotypic stand of Eucalyptus trees with a thick mulch of Eucalyptus tree leaves.

Response to fire:

Eucalyptus stands can be fire retardant to low intensity fires. Low intensity fires will consume the leaf litter and can be carried into the canopy where leaves are singed or tops are burned. High intensity fires are typically stand destroying.

Forests

Vegetation Types:

Coniferous forests occur in the lower to upper montane zone in the Peninsula Ranges. The lower montane forests typically include the Southern Interior Cypress Forest which is intermixed with oak woodlands and chaparral. Upper montane forests include Coulter Pine Forest, Jeffery Pine Forest, and mixed Sierran Forest. They range from pure stands of a single species to mixed conifer forests intermixed with oak woodlands and chaparral.

Response to Fire:

Montane forests are typically surrounded by chaparral or adjacent to forests subject to fire, and are therefore susceptible to fire. When fires occur more frequently than twenty-five years, Coulter pine habitat conversion to chaparral may result. Jeffery Pine Forests and Mixed Coniferous Forests historically

experience periodic low-to-moderate intensity fires in the under story. Fuel buildup due to fire suppression can increase the risk of stand replacing crown fires.

Chaparral

Vegetation Types:

Chaparral occurs throughout the coastal lowlands, foothills, and montane region. This community typically forms a dense, almost impenetrable shrub community with no herbaceous layer. Chaparral is a highly variable plant community that includes; Chamise Chaparral, Coastal Sage-Chaparral Scrub, Mixed Chaparral, Montane Chaparral, Semi-desert Chaparral, and Scrub Oak Chaparral.

Response to Fire:

Chaparral is a fire adapted community that stump sprouts or germinates from seed after a low-to–moderate intensity burn. Large fires often result in homogenous stands of chaparral. Frequent fires and hot fires can burn the root system and surface seed bank resulting in a loss of diversity and low-density vegetative communities. For a few years after a fire, annual forbes germinate and establish on site until the woody shrubs mature.

Coastal Sage Scrub

Vegetation Types:

Locally, Coastal Sage Scrub consists of low, woody soft-shrubs and is classified as Diegan Coastal Sage Scrub (DCSS). DCSS is dominated by California sagebrush and/or flat-topped buckwheat and often intergrades with Chaparral communities.

Response to Fire:

DCSS species are fire adapted and quickly regenerate from seed after a fire. However, frequent fires in an area can reduce the seed bank for native shrub

species and increase the presence of non-native grasses and forbs resulting in degraded habitat. Once this habitat conversion occurs, DCSS species typically do not re-colonize the area due to competition from dense populations of invasive grasses that increase the fire frequency. Areas with moderate to highly degraded DCSS may convert to non-native grasslands due to the 2003 fires.

Big Sagebrush Scrub

Vegetation Types:

Locally, big sagebrush is dominated by; flat-topped buckwheat, broom snakeweed, deerweed, sawtoothed goldenbrush, and includes a variety of DCSS species.

Response to Fire:

The fire ecology of Big Sagebrush Scrub in eastern San Diego County is not well documented. Many of the associates in this community occur in DCSS and are fire adapted. Frequent fire in the vegetative community will result in habitat conversion to non-native grasslands.

Grasslands

Vegetation Types:

Perennial Grasslands vary among Valley Needlegrass and Valley Sacaton grasslands. Valley Needle Grassland is dominated by the tussock forming purple needlegrass, with a variety of native forbs including colar lupin, rancher's fireweed, and adobe popcorn-flower; and the native bunchgrasses, foothill needle grass, and coast range melic. The species composition can vary as it transitions into the foothills and montane zone. Valley Sacaton Grassland is dominated by sacton or salt grass. This community typically occurs in the areas with a high seasonal water table and is often associated with Alkali Seeps and Alkali Meadows. Non-native grasslands are dominated

by red brome, ripgut brome, and softchess brome. Non native grasslands often intergrade with open oak woodlands and disturbed DCSS communities.

Response to Fire:

Grassland communities in San Diego County have evolved with, and are typically maintained by fire. Fire in non-native grasslands maintains dominance by invasive grasses and prevents establishment by native shrub species.

Meadows

Vegetation Types:

Montane Meadows occur in the montane zone and are dense growth of sedges and perennial herbs that experience wet cold winters. Montane Meadows are typically interspersed with montane forests. Wildflower Field is an amorphous community of herbaceous plant species where dominance varies from site to site and year to year, depending on climatic factors. Wildflower Field is typically associated with grasslands and oak woodlands in the valleys and foothills.

Response to Fire:

Wet meadows typically do not burn since the moisture content in the plants and soils retard fire advance. During drought times and in dry meadows fire will quickly burn through these communities. Fall fires typically have little impact on local meadows since most plants are dry and have dispersed their seed.

Riparian

Vegetation Types:

Riparian communities vary depending on the aquatic system they are associated with and can have seral stages of community succession. Mulefat Scrub and Southern Willow Scrub are typically early seral stages for Southern

Cottonwood-Willow Riparian Forest, which develops into Southern Coast Live Oak Riparian Forest. In steep drainages, Mulefat Scrub and Southern Willow Scrub may be early stages for Southern Sycamore-Alder Riparian Forest or White Alder Riparian Forest.

Response to Fire:

Riparian communities often resist fire since riparian species do not experience drought. During drought, riparian species become more susceptible to fire. Stand destroying fires can assimilate flooding events in that they set communities back to early seral stages. Stump sprouting species can reestablish in the early successional communities. Most mature trees that experience high intensity fires will die.

Wetlands

Vegetation Types:

Wetland communities are highly variable. Riparian and Wet Meadows are communities that can establish in areas with sufficient hydrology to be considered wetlands. In addition, emergent wetlands occur along seeps and as emergent wetlands in shallow water. These wetlands include Alkali Seep, Freshwater Seep, and Freshwater Marsh.

Response to Fire:

Historically, fire impacts to wetlands in San Diego County are not documented. Wetlands typically do not experience fire. Many wetland species are rhizomous and will likely survive fires. Woody species in scrub and forested wetlands may recover from fire by epicormic sprouting from stems or basal sprouting from roots.

Otay and Dulzura Watersheds:

Vegetation within the Otay Watershed is dominated by native scrub and chaparral (Figure 3-3.6, Table 3-3.4). Southern Interior Cypress Forest and oak woodlands are also native communities that are represented within the watershed. In addition, communities of grasslands exist throughout the watershed. In several areas, native vegetation has been altered due to agriculture and urban development. These areas possess the potential to negatively impact water quality (see Land Use, Rainfall and Runoff).

Several riparian and wetland habitats exist in the Otay Watershed. These communities include Willow Scrub, Freshwater Marsh, Cismontane Alkali Marsh, disturbed wetland, Lakeshore Fringe, Vernal Pools, and various types of riparian forest. They occur primarily around the perimeter of Otay Reservoir and in the canyons and drainages. The disturbed wetlands occur along Jamul and Dulzura Creeks. A restoration project is currently underway on Dulzura Creek, east of the Thousand Trails RV Park. Vernal Pools are found east and north of Lower Otay Reservoir. In addition, Willowy Monardella (*Monardella linoides* ssp. *viminea*) a sensitive species is known to exist east of lower Otay Reservoir.

The Dulzura Watershed is dominated by native Mixed Chaparral (Figure 3-3.6, Table 3-3.4). Patches of grasslands and non-native vegetation occur in several areas. Southern Coast Live Oak Riparian Forest is the only riparian community well represented in Dulzura Watershed

Table 3-3.4 Vegetation in the Otay and Dulzura Watersheds		
Vegetation Type	**Acres**	**% of Watershed**
Wetlands	256	0
Forest	3186	5
Grasslands, Vernal Pools, Meadows, other Herb Communities	2536	4
Non-Native Vegetation, Developed or Un-vegetated Habitat	7860	11
Riparian	863	1
Scrub and Chaparral	53226	76
Woodland	2396	3
Total	70323	100.0

Cottonwood Watershed:

The dominant vegetation community within the Cottonwood Watershed is native Mixed Chaparral (Figure 3-3.7, Table 3-3.5). Other native communities that are represented include Jeffrey Pine Forest, Mixed Coniferous Forest, and Woodlands. Patches of grasslands and non-native vegetation occur in several areas. Several riparian and wetland habitats exist in the Cottonwood Watershed. These communities include Southern Cottonwood Willow Riparian Forest, Southern Coast Live Oak Riparian Forest, White Alder Riparian Forest, Willow Riparian Scrub, Wet Montane Meadow, Lakeshore Fringe, Freshwater Seep, and Freshwater Marsh. In addition, Parish's Meadowfoam (*Limnanthes gracilis* var. *parishii*) is a sensitive species known to occur in the watershed.

Table 3-3.5 Vegetation in the Cottonwood Watershed		
Vegetation Type	**Acres**	**% of Watershed**
Wetlands	1	0
Forest	12211	8
Grasslands, Vernal Pools, Meadows, other Herb Communities	5742	4
Non-Native Vegetation, Developed or Un-vegetated Habitat	4122	3
Riparian	2454	2
Scrub and Chaparral	117332	78
Woodland	8408	6
Total	150270	100.0

Rainfall and Runoff

The climate of San Diego County is classified as a Mediterranean dry summer type where 90% of the annual rainfall occurs between the months of November and April. Annual precipitation varies from 9 inches at the coast to 25 inches near the mountains. Storm water runoff occurs when water from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, streets and parking lots prevent the runoff from naturally soaking into the ground. Storm water runoff can collect debris, sediment, nutrients, bacteria, pathogens, chemicals and deposit them directly into a lake, stream, river, wetland, or coastal water.

Rainfall and Runoff information in this section was supplied by the City of San Diego Water Department, Hydrography Section. Rainfall data is collected at each reservoir by a weather station. Runoff data is estimated monthly by measuring the following: amount of rainfall, rain amount on surface of lake, other inputs, evaporation, draft, leaks, and change in lake level.

Otay, Dulzura and Cottonwood Watersheds:

Table 3-3.6 shows annual rainfall and runoff at each of the three reservoirs in the Otay, Dulzura and Cottonwood Watersheds. Rainfall totals for years 2001-2003 were average or below average. The winter of 2004-2005 was the third wettest on record.

Table 3-3.6 Rainfall and Estimated Runoff for Cottonwood Watershed Reservoirs			
Reservoir	**Year**	**Rainfall (in.)**	**Runoff Entering Reservoirs (M.G.)**
Barrett	2001	13.69	134.83
	2002	8.15	70.92
	2003	13.61	251.69
	2004	20.68	575.24
	2005	14.88	7121.42
Otay	2001	10.4	92.36
	2002	5.96	171.92
	2003	8.48	324.67
	2004	14.24	905.8
	2005	11.78	7199.84
Morena	2001	17.43	1402.3
	2002	8.73	74.85
	2003	18.45	59.64
	2004	27.67	70.42
	2005	19.45	3717.48

Fires

The California Department of Forestry (CDF) addresses all large brush fires within the watershed. The local fire districts handle structural fires only. CDF has an extensive fire prevention plan which includes three fire safe guidelines: residential, railway, and electrical power lines. CDF also provides an evaluation of burned sites and a re-growth plan to prevent erosion immediately following a fire.

Fire can indiscriminately devastate certain vegetation and wildlife communities, but is very important to the sage scrub and chaparral communities. Many taxa of coastal sage scrub plants are adapted to fire by stump sprouting or high seed production (Skinner et al., 1994). Similarly, many chaparral plants are adapted to frequent fires either through resprouting or seed carry-over (see Vegetation). While these communities are adapted to fire and usually recover in three to five years following such an event, the soils are subject to increased erosion immediately following a burn (see Fires, Soils).

Sediment from the burned areas can impact streams and the aquatic organisms within those streams, ultimately feeding into reservoirs where sediment loads may affect treatment procedures. Control of large fires is important from both a preservation perspective as well as a watershed management perspective.

The fire and water districts in the watershed do not measure the water quality impacts of the runoff from burned areas (Calhoun, Justice, Bratton, 1995). In most cases the County Office of Emergency Response or the local Fire Department contacts the RWQCB to visit the site after the fire is contained. The RWQCB participates in assessing the impact of the fire on the surface water quality, and will determine if monitoring is necessary. Fire information in this report is supplied by the California Department of Forestry. The current data available from CDF is through December 31, 2004

Otay, Dulzura and Cottonwood Watersheds:

Since 2000, there have been seven fires in the Otay, Dulzura and Cottonwood Watersheds (Figure 3-3.8, Table 3-3.7*).*

Table 3-3.7 Otay, Dulzura and Cottonwood Watershed Fires

Name	Alarm Date	Acres Burned
Bobcat	8/24/2002	738
Cedar	10/25/2003	8,986
Garnet	7/13/2002	1
Mine/Otay	10/26/2003	27,907
Pines	7/29/2002	195
Sheephead	7/6/2004	16
Troy	1/3/2001	1,558

With the exception of the Otay fire, little to no impact was observed on the source water bodies in these watersheds. The Otay fire started on October 26, 2003 and by the time it was contained, more than 44,000 acres of grass, chaparral and Tecate cypress forest had burned. This area represents 45% of the Otay Watershed. The staff of the City of San Diego Water Department,

which monitories the water quality of Otay Reservoir and the streams that enter it, observed significant sedimentation in the Otay Watershed from the burn areas (City Staff, personal communication). These effects were especially evident during the winter of 2004-2005 when San Diego County experienced near record rainfall.

Summary of Potential Contaminant Sources

Land Use -

The section on land use includes; land ownership, category of land use, and population density.

Land Ownership

The land ownership information discussed in this section is primarily derived from SanGIS data. SanGIS maintains a database of land ownership information, by parcel, for San Diego County.

Otay and Dulzura Watersheds:

Approximately 59% of the Otay/Dulzura Watershed is privately owned, while 41.1% is in public ownership (Figure 3-3.9, Table 3-3.8). The land area owned by the City of San Diego is 3,555 acres, or 5.1% of the watershed.

Table 3-3.8 Land Ownership in Otay/Dulzura Watershed

Ownership Category	**Area (acres)**	**% of Watershed**
Indian Reservation	7	0.0
Publicly Owned		
Local	6178	8.1
State	7539	9.8
Federal	17715	23.1
Subtotal Publicly owned	31432	41.1
Private	45128	58.9
Total	76567	100

Cottonwood Watershed:

Approximately 14% of the Cottonwood Watershed is privately owned, while 81% is in public ownership. (Figure 3-3.10, Table 3-3.9).

Table 3-3.9 Land Ownership in Cottonwood Watershed		
Ownership Category	**Area (acres)**	**% of Watershed**
Indian Reservation	7964	5.1
Publicly Owned		
Local	7945	5.1
State	3649	2.3
Federal	115400	73.8
Subtotal Publicly owned	126994	81.2
Private	21431	13.7
Total	156389	100

Existing Land Use -

The information discussed in this section is based on SanGIS data. It is important to note that some areas reported in the 1996-2000 Watershed Sanitary Survey (WSS) as vacant and undeveloped land use have been updated by SanGIS to reflect its correct land use type, parks and open space preserves.

Otay Watershed:

Land use in the Otay Watershed has experienced little change since 2000 (Figure 3-3.11, Table 3-3.10). Otay Watershed is relatively undeveloped with approximately 90% of its land use type fitting into the following categories: vacant and undeveloped (51%), parks and open space preserves (36.7%), and water (1.6%). Approximately 7% of the total watershed is occupied by urban development, such as residential and commercial land uses (see Rainfall and Runoff). Agriculture accounts for approximately 2% of the land area in the Otay Watershed.

Table 3-3.10 Existing Land Use in the Otay Watershed		
Land Use Category	**Area (acres)**	**% of Watershed**
Agriculture	1105.13	1.75
Commercial Recreation	457.49	0.72
Commercial	7.55	0.01
Industrial	22.88	0.04
Parks	23226.30	36.73
Schools, Hospitals, Public & Private Institutions	90.32	0.14
Single Family Residential	103.85	0.16
Spaced Rural Residential	4137.79	6.54
Under Construction	17.50	0.03
Transportation, Communication & Utilities	659.76	1.04
Water	1031.55	1.63
Subtotal	30860.12	48.81
Vacant and Undeveloped	32370.57	51.19
Total	63230.69	51.19

Dulzura Watershed:

Land use in the Dulzura Watershed has experienced little change since 2000 (Figure 3-3.11, Table 3-3.11). Dulzura Watershed is relatively undeveloped with approximately 90% of its land use type fitting into the following categories: vacant and undeveloped (62%), parks and open space preserves (28%). Approximately 9% of the watershed is developed for residential purposes, which is a 3% increase since the 1996-2000 WSS (see Rainfall and Runoff). No commercial agriculture occurs in the Dulzura Watershed.

Table 3-3.11 Existing Land Use in the Dulzura Watershed		
Land Use Category	**Area (acres)**	**% of Watershed**
Parks	2004.97	28.27
Group Quarters Residential	16.49	0.23
Spaced Rural Residential	643.79	9.08
Transportation, Communication & Utilities	52.27	0.74
Subtotal	2717.52	38.32
Vacant and Undeveloped	4374.22	61.68
Total	7091.74	100.00

Cottonwood Watershed:

Land use in the Cottonwood Watershed has experienced little change since 2000 (Figure 3-3.12, Table 3-3.12). Cottonwood Watershed is relatively undeveloped with approximately 96% of its land use type fitting into the following categories: vacant and undeveloped (76%), parks and open space preserves (18%), and water (1.6%). Agriculture accounts for approximately 2% of the land area in the Cottonwood Watershed.

Table 3-3.12 Existing Land Use in the Cottonwood Watershed		
Land Use Category	**Area (acres)**	**% of Watershed**
Agriculture	2591.49	1.66
Commercial Recreation	357.84	0.23
Commercial	18.80	0.01
Parks	27705.31	17.72
Schools, Hospitals, Public & Private Institutions	96.50	0.06
Group Quarters Residential	75.98	0.05
Mobile Home Parks	15.75	0.01
Single Family Residential	423.39	0.27
Spaced Rural Residential	1140.73	0.73
Transportation, Communication and Utilities	2495.44	1.60
Water	2478.28	1.58
Subtotal	37399.51	23.91
Vacant and Undeveloped	118989.58	76.09
Total	156389.09	76.09

Agriculture -

Agricultural practices can be a significant source of non-point source contaminants. Contaminants that are often found in typical agricultural surface runoff include sediment, nutrients, pesticides and bacteria. Increases in salinity may also pose a significant water quality problem in the future. The United States Environmental Protection Agency (USEPA) has estimated that about 75% of the sediment, 52% of the nitrogen loading, and 70% of the phosphorus loading that enters waterways of the 48 contiguous states originates in agricultural settings. Most contaminants are transported to the water supply through either surface runoff or irrigation return flows.

Agricultural practices consist of field crops, orchards and vineyards, and intensive agriculture; home gardens and hobby farms are not included in this report.

Field crops include; grain, alfalfa and sod. Due to the minimal use of pesticides and other chemicals, this agricultural practice is considered to have the lowest potential of impacting water quality.

Orchards and Vineyards include; apples, avocados, citrus, grapes and other non-evergreen fruit, while intensive farm plots include; row crops such as herbs, vegetables, poultry ranches, and dairy farms. Due to their reliance on pesticides and other chemicals, these practices are considered to have a greater potential of impacting water quality.

Poultry ranches are regulated by the San Diego County Department of Environmental Health for fly breeding and facilities are inspected annually. Poultry Farms do not discharge a significant amount of wastewater, but impact to water quality is possible during periods of rain when runoff could

carry manure into nearby drainages. Manure management methods include frequent cleaning, drying and coning. Manure is generally spread on the ground to dry, pushed into windrows and then removed from the ranch.

Dairy farms are permitted by the Regional Water Quality Control Board (RWQCB) and facilities are inspected quarterly. The RWQCB issues orders specific to individual dairies. These orders contain facility designs, operation specifications and discharge specifications, along with other guidelines for complying with the Watershed Basin Plan. Dairy farms are then required to submit quarterly reports to the RWQCB that describe herd size, manure disposal, groundwater monitoring results including nitrates and dissolved solids. Milk cows, corrals and barns are generally washed daily. Dairies typically have retention ponds for wastewater discharge which during periods of rain could overflow and impact the water quality of nearby streams.

Otay and Dulzura Watersheds:

The information discussed in this section is based on SanGIS data and two layers created by RECON Environmental Consultants using information from the San Diego County Department of Environmental Health and RWQCB. Since 2000, lands used for agriculture in the Otay/Dulzura Watersheds have decreased from 3,075 acres to 1,180 acres (Figure 3-3.11, Table 3-3.13). No permitted poultry ranches or cattle farms exist within the Otay or Dulzura Watersheds.

Table 3-3.13 Agriculture in the Otay and Dulzura Watershed

Type of Agriculture	Acres	% of Watershed
Orchard	120	0.1%
Intensive	74	0.1%
Field Crops	986	1.5%
Total	**1180**	**1.7%**

Cottonwood Watershed:

No changes have occurred in Agriculture since 2000. Agriculture accounts for 2,778 acres of the Cottonwood watershed (Figure 3-3.12, Table 3-3.14). No permitted poultry ranches or cattle farms exist within the Cottonwood Watershed.

Table 3-3.14 Agriculture in the Cottonwood Watershed

Type of Agriculture	Acres	% of Watershed
Orchard	0	0%
Intensive	0	0%
Field Crops	2778	1.7%
Total	**2778**	**1.7%**

Grazing -

The animal grazing data presented derives from two sources: the Bureau of Land Management (BLM), and the United States Forest Service (USFS). Although grazing on private land occurs in this watershed, no spatial data was available for such areas, and grazing on these lands is not included in this report. The USFS allows an average density of one animal per 160 acres; therefore, the risk of water contamination from manure is low. However, loss of vegetation cover associated with grazing may increase soil erosion and sedimentation of streams and reservoirs (see Vegetation, Rainfall and Runoff).

Otay and Dulzura Watersheds:

Since 2000, all BLM lands permitted for grazing (6338 acres) in the Dulzura and Otay watersheds are currently in nonuse status (Figure 3-3.1, Table 3-3.15).

Table 3-3.15 Grazing in the Otay and Dulzura Watersheds				
Range Name	**Number of Head**	**Acres in Watershed**	**Ownership**	**Permit Status**
Otay Mountain	686	NA	BLM	Nonuse
Dulzura	1441	21	BLM	Nonuse
Mother Grundy	4215	16	BLM	Nonuse

Cottonwood Watershed:

Since 2000, the McCain Valley Tierra Range has been closed (447 acres) and the following rangelands permits have taken on nonuse status: Indian Creek (2780 acres), Morena (745 acres), Pine Valley (7402 acres) and Red Top (15957 acres). Currently, 54,950 acres of permitted grazing land are in the active status within the Cottonwood Watershed (Figure 3-3.1, Table 3-3.16).

Table 3-3.16 Grazing in the Cottonwood Watersheds				
Range Name	**Number of Head**	**Acres in Watershed**	**Ownership**	**Permit Status**
Clover Flat	715	49	BLM	Active
Corte Madera	79	11525	USFS	Active
Guatay	20	853	USFS	Active
Hauser Mountain	66	203	BLM	Active
Indian Creek	75	2780	USFS	Nonuse
Laguna	209	28166	USFS	Active
Laguna Meadow	175	5858	USFS	Active
Morena	0	745	USFS	Nonuse
Pine Valley	30	7402	USFS	Nonuse
Red Top	120	15957	USFS	Nonuse
Samataguma	0	958	USFS	Active
Thing Valley	22	7338	USFS	Active

Population Density -

Population density is a good indicator of the level of urbanization within an area. Land areas with small population densities are usually rural with natural landscapes that trap rainwater and allow it to filter slowly into the ground (see Rainfall and Runoff). In contrast, large population densities are associated

with urbanized areas. These areas contain impervious surfaces that prevent rain from infiltrating into the ground which increases the amount and velocity of runoff. Urbanization increases the variety and amount of pollutants carried into streams, rivers, and lakes. These pollutants can harm fish and wildlife populations, kill native vegetation, foul drinking water supplies, and make recreational areas unsafe and unpleasant. The population data presented was derived form SANDAG's 2000 Census.

Otay and Dulzura Watershed:

The estimated 2005 population of the watershed is approximately 9,117 people for Otay and 3,874 people for Dulzura (Table 3-3.17). This reflects a population increase of about 5% for Otay, and a 48% increase for Dulzura in the past five years. The average population density throughout the combined watersheds is approximately 0.18 persons per acre. The most densely populated area within the watershed is the well developed town of Jamul (Figure 3-3.13).

Cottonwood Watershed:

The estimated 2005 population of the watershed is approximately 6,341 people (Table 3-3.17). The population has increased 2%, in the past five years. The average population density throughout the watershed is approximately 0.04 persons per acre. The populated area concentrations within the watershed are Morena Village and Pine Valley (Figure 3-3.14).

Table 3-3.17 Populations for Cottonwood / Otay System Watersheds

Watershed	Population	Density (Persons/Acre)
Otay WS	9,117	0.14
Dulzura WS	3,874	0.54
Cottonwood WS	6,341	0.04
City of Pine Valley	1,501	0.32

Mines -

The mine data presented was obtained from USGS and SWRCB. The SWRCB and the RWQCB are given authority over mines. The most common environmental hazard is: heavy metals associated with acid-rock drainage; methyl mercury from mercury-contaminated sediments; arsenic; asbestos and chromium.

Otay, Dulzura and Cottonwood Watersheds:
In the 1996-2000 Watershed Sanitary Survey there were twenty-four mines listed by the State Water Resources Control Board (SWRCB). Currently there are no active mines listed within the Otay, Dulzura and Cottonwood Watersheds.

Hazardous Materials -

The data presented in this section was obtained from the San Diego County Health Department, RWQCB, and the Solid Waste Assessment Test Program. The hazardous materials were put into three categories: Liquid Hazardous Waste, Solid Hazardous Waste and Liquid Hazardous Storage (capacity). The majority of liquid waste is stored in 55 gallon drums and hauled away by licensed waste haulers. Automotive and Tractor fuels make up the majority of permitted liquid hazardous storage. These fuels are stored in underground fiberglass-reinforced plastic, cathodically protected steel, or steel clad with fiberglass-reinforced plastic. These tanks are installed with a leak interception and detection system.

The State Resources Control Board affected changes to the underground storage tank regulations on 13 October 2005. These changes can be found in Title 23, California Code of Regulations, Chapter 16.

Table 3-3.18 Summary of Permitted Hazardous Material			
Watershed	**Liquid Waste (gal)***	**Solid Waste (lbs)***	**Liquid Storage (gal)***
Otay & Dulzura	2,054	1,767	42,700
Cottonwood	4,870	2,918	267,960
Total	**6,924**	**4,685**	**310,660**

* Figures are maximum capacities

Otay, Dulzura and Cottonwood Watersheds:

Hazardous Materials/Waste amounts and locations for the Otay, Dulzura and Cottonwood Watersheds are illustrated in Figure 3-3.1, Table 3-3.18.

Recreation -

Otay Reservoirs

The primary purpose of Upper and Lower Otay Reservoirs are for domestic water supply, while recreation is a secondary use of the reservoirs. The reservoirs are open to the public for boating and fishing use, three days a week, February through October, and to all other recreational activities, seven days a week, year around. Recreational activities include; boating, fishing, jogging, biking, and picnicking. Water contact activities are not permitted at the reservoir (Table 3-3.19).

Table 3-3.19 Otay Reservoir Number of Permits Sold				
Year	Fishing	Launch	Rentals	
			Motor	Row
2001	19069	5081	NA	2290
2002	21695	6601	NA	2314
2003	18602	5362	NA	1642
2004	15822	4252	1399	789
2005	Figures not reconciled			

The facilities consist of concession, launch, rental boats, trash receptacles, portable toilets, two floating restroom facilities, and a comfort station. These facilities are owned and operated by the City of San Diego. There are no

boat-holding tank pump-out stations, marinas, or berths available at the reservoirs. Trash cans and portable toilets are placed above current water levels.

Lower Otay Reservoir has a restricted access area encompassing the outlet tower. This area is demarcated by a floating barrier to prevent direct recreational contact to the water immediately available to the Otay Water Treatment Plant.

The potential sources of contamination associated with the recreational activities include; erosion, trash, microorganisms associated with humans and animals, spillage of petroleum products, and production of combustion byproducts. Title 22 contaminants are monitored quarterly and nutrients monthly (Figure 3-3.1). Microorganisms including Total Coliforms, E. coli, and Enterococcus are monitored weekly.

Barrett Reservoir:

The primary purpose of Barrett Reservoir is for domestic water supply, while recreation is a secondary use of the reservoir. Barrett reservoir is open to the public for recreational use, three days a week, April through September. Recreational activities include; boating, fishing, hunting and hiking. Water contact activities are not permitted at the reservoir (Table 3-3.20).

Table 3-3.20 Barrett Reservoir Number of Permits Sold

Year	Fishing	Hunting	Launch	Rentals	
				Motor	Row
2001	3473	381	NA	1556	286
2002	3530	330	NA	1529	244
2003	4609	447	NA	1819	307
2004	4468	365	NA	1570	291
2005	Figures not reconciled				

The facilities consist of rental boats, trash receptacles, and portable toilets. There are no boat-holding tank pump-out stations, marinas, or berths available at the reservoirs. Trash cans and portable toilets are placed above current water levels.

The potential sources of contamination associated with the recreational activities include; erosion, trash, microorganisms associated with humans and animals, spillage of petroleum products, and production of combustion byproducts. Title 22 contaminants are monitored quarterly (Figure 3-3.1).

Morena Reservoir:

The primary purpose of Morena Reservoir is for domestic water supply, while recreation is a secondary use of the reservoir. Morena reservoir is open to the public for recreational use seven days a week year around. Recreational activities include; boating, fishing, hiking, biking, picnicking, and over-night camping. Water contact activities are not permitted at the reservoir (Table 3-3.21).

Table 3-3.21 Morena Reservoir Number of Permits Sold

Year	Fishing	Launch	Rentals	
			Motor	Row
2001	6792	815	1035	165
2002	8161	979	1071	151
2003	7410	890	1030	195
2004	8558	1027	786	237
2005	9649*	1308*	747*	228*

* Figures are estimates provided by the County of San Diego

The facilities consist of concession, launch, rental boats, trash receptacles, portable toilets and comfort stations. These facilities are owned and operated by the County of San Diego. There are no boat-holding tank pump-out stations, marinas, or berths available at the reservoirs. Trash cans and portable toilets are placed above current water levels.

The potential sources of contamination associated with the recreational activities include; trash, microorganisms associated with humans and animals, spillage of petroleum products, and production of combustion byproducts. Title 22 contaminants are monitored quarterly (Figure3-3.1).

Wastewater / Reclaimed Water -

Otay and Dulzura Watersheds:

There are no Wastewater / Reclaimed Water treatment facilities permitted by the RWQCB in the Otay/Dulzura watershed. Otay Water District has a reclaimed water distribution system located on the western boundary of the watershed (Figure 3-3.1). The system is supplied by the Ralph W Chapman Water Reclamation Facility. Otay Water District is the agency responsible for the facility. The facility is not located in the Otay/Dulzura watershed.

Cottonwood Watershed:

The Pine Valley Sanitation District is the only wastewater treatment facility permitted by the RWQCB in the Cottonwood Watershed (Figure 3-3.1, Table 3-3.22).

Table 3-3.22 Wastewater / Reclaimed Water Facilities

RCQCB Facility I.D.	Facility Name	Address	Highest level of Treatment	Discharge To:	Land Disposal Order #
9000000099	Pine Valley SD	260 Sawday Street	Un-disinfected Secondary	Percolation Ponds	94-161

Pine Valley Sanitation District:

The County of San Diego is the agency responsible for this facility. RWQCB Order No. 94-161 establishes the discharge specifications for the Pine Valley SD facility (Table 3-3.23).

The treatment and disposal system is comprised of; an aerated lagoon with a 72 day detention time, and eight percolation beds. The long detention time causes a severe algae problem which contributes to high biochemical oxygen demand and suspended solids in the effluent. The RWQCB requirements certify a maximum discharge of 0.040 mgd.

Table 3-3.23 Pine Valley Sanitation District Effluent Discharge Limitations, Order # 94-161

Constituent	Unit	12-Month Average
Biochemical Oxygen Demand	mg/L	30
pH	Within the limits of 6.0 to 9.0 at all times	
Total Dissolved Solids	mg/L	750
Chloride	mg/L	250
Sulfate	mg/L	250
Nitrate (as NO_3)	mg/L	30

Biosolids Disposal Practices*:*

The facility has a complete oxidation process. There is no solid waste generated from the treatment process at this facility.

Septic Systems -

Otay, Dulzura and Cottonwood Watersheds:

The primary goal in this section is to identify areas where septic systems may pose a threat to water quality. Septic systems treat and disperse relatively small volumes of wastewater from individual or small numbers of homes and commercial buildings. Poorly managed systems have been named as a

concern by nearly every federal and state program that deals with water resource issues.

San Diego County's Department of Environmental Health maintains records of septic tank permits at their San Marcos and El Cajon offices. Prior to 2002 no electronic database existed to query the location, type, etc. of these permits. There are an estimated 90,000-100,000 homes county-wide on septic systems.

Estimates of septic system density for the 1996-2000 WSS were calculated by using the 1990 census tract data to determine population density within each watershed. Next, a data layer of sewered and un-sewered areas was created from the City data base and from SanGIS community plan data. The sewered areas layer was overlaid with population density to create a new data layer. This data layer was queried to pull out polygons that were un-sewered with a population density greater than zero. Graduated color was applied to the septic density field to enable visual assessment of high potential concentrations of septic tanks.

In 2002 the County of San Diego Department of Environmental Health initiated an electronic database to track septic system permits issued throughout the County. The database does not contain historical permits issued before 2002, so an exact number of permits in a given community cannot be determined. However, the database indicates where new permits are being issued and if these permits are for new construction, repair, fire rebuild, etc. In addition, the permit records the hydrologic sub area where the septic system is located.

A data layer of the hydrologic sub areas of San Diego County was obtained from SanGIS. Numbers of permits issued in each hydrologic sub area was

determined from the Counties database. Graduated colors were applied to the hydrologic sub area within each watershed to enable visual assessment of high issuant of septic system permits (Figure 3-3.15). Table 3-3.24 lists the communities within the watershed along with the number and type of septic system permits issued since 2002.

Table 3-3.24 Number and Type of Septic System Permits in the Cottonwood, Dulzura and Otay Watershed

	Type of System			
Community	**New**	**Repair or Modified**	**Fire Rebuild**	**Other**
Alpine	4	0	0	2
Campo	10	15	0	1
Dulzura	8	3	0	0
Jamul	79	25	0	1
Lake Morena	4	2	0	0
Pine Valley	19	33	0	0

Sanitary Sewer Overflows -

Otay and Dulzura Watersheds:

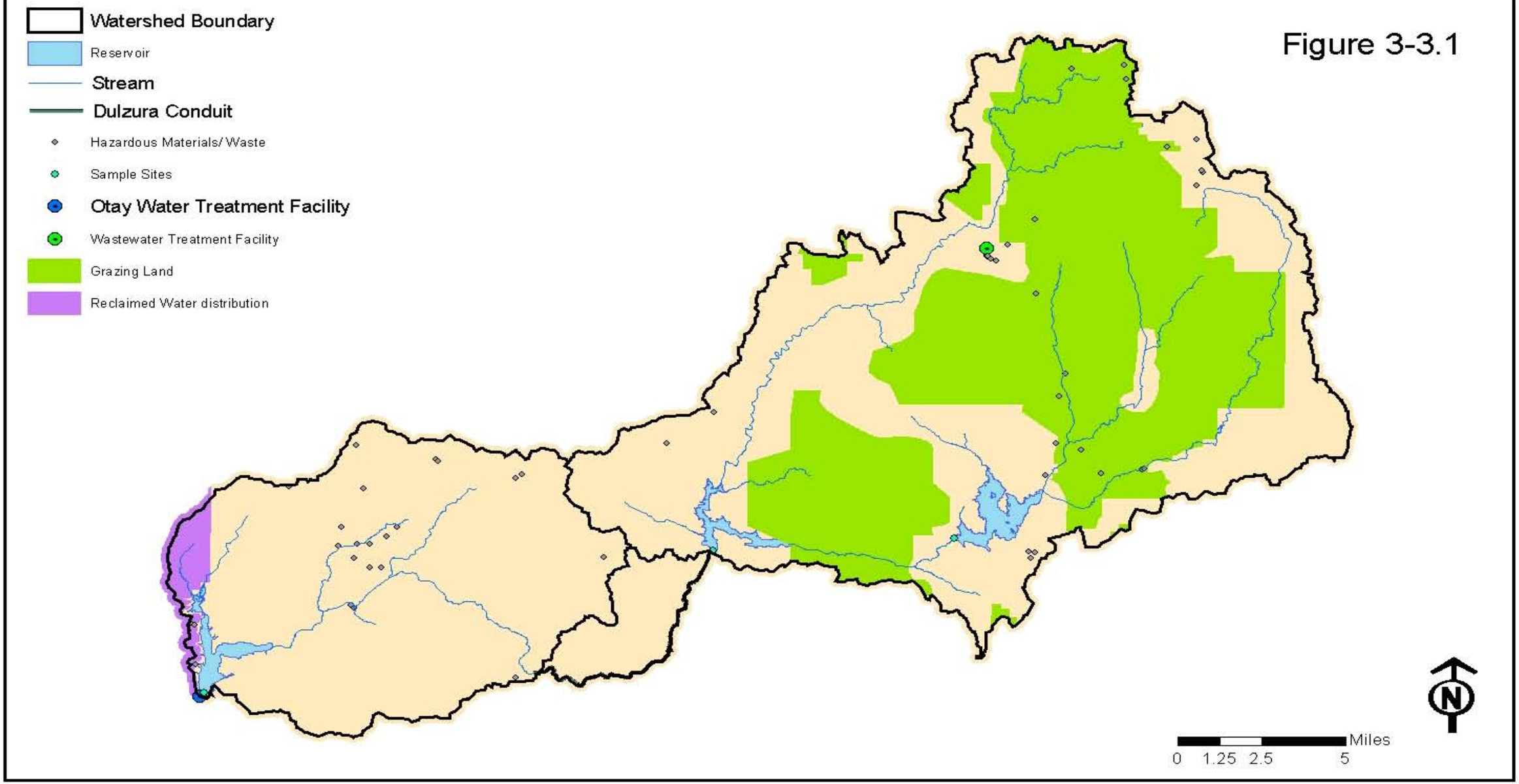
There were no sanitary sewer overflows in the Otay/Dulzura Watershed reported to the Regional Water Quality Control Board (RWQCB) from 2001 through 2004. The current data available from the RWQCB is through June 30, 2004. Detailed information regarding sanitary sewer overflows is available at the Regional Water Quality Control Board website (www.swrcb.ca.gov/rwqcb9).

Cottonwood Watershed:

There were no sanitary sewer overflows in the Cottonwood Watershed reported to the Regional Water Quality Control Board (RWQCB) from 2001 through 2004. The current data available from the RWQCB is through June 30, 2004. Detailed information regarding sanitary sewer overflows is available at the Regional Water Quality Control Board website (www.swrcb.ca.gov/rwqcb9).

Otay, Dulzura & Cottonwood Watersheds GENERAL SETTING

Figure 3-3.1



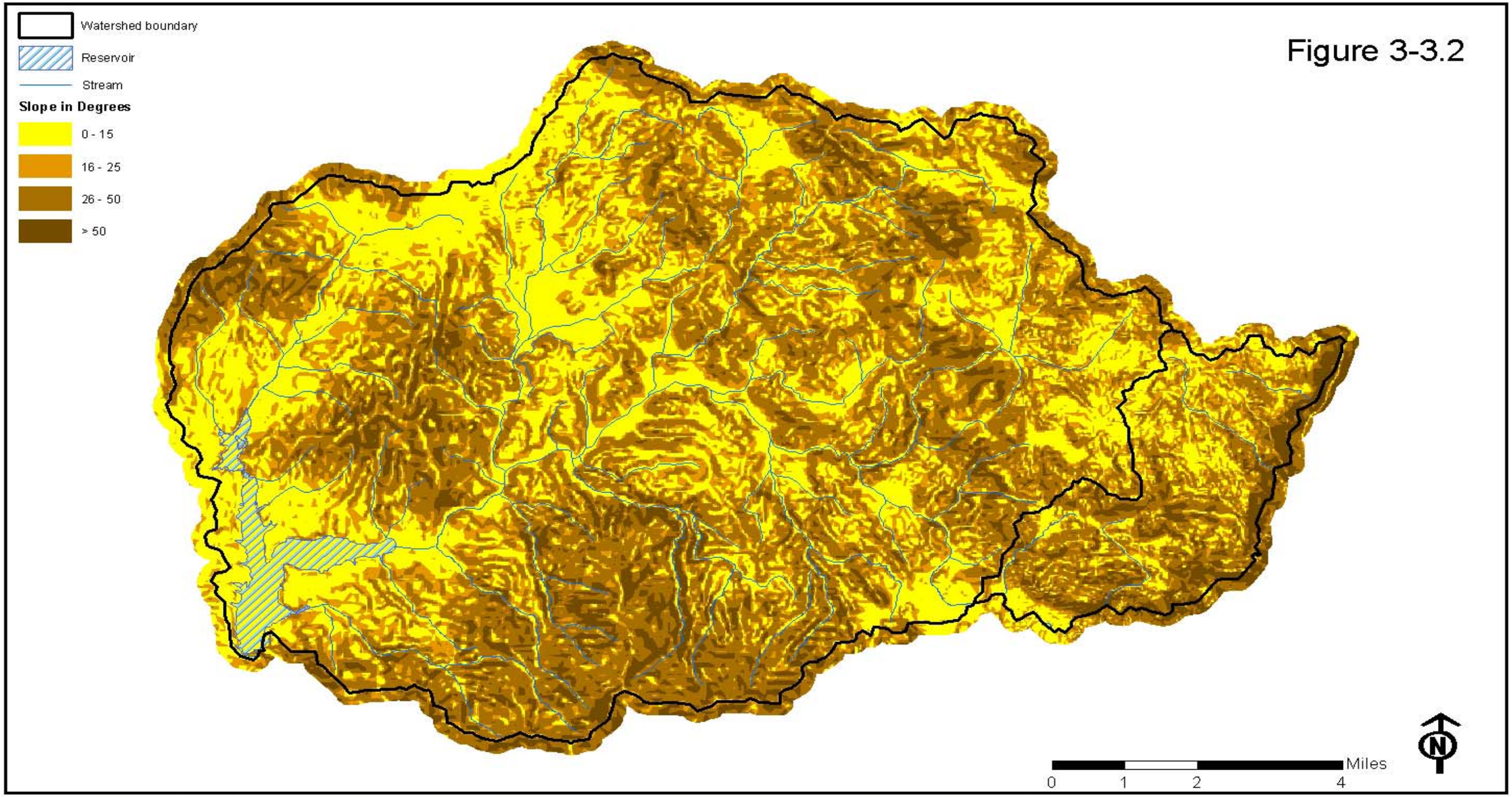
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey 2005\General Setting\2005 OtayDulzura & Cottonwood Watersheds General Settings.mxd
Created By: Dennis Brown

Date: 1 December 2005

SanGIS

Otay & Dulzura Watersheds SLOPE

Figure 3-3.2



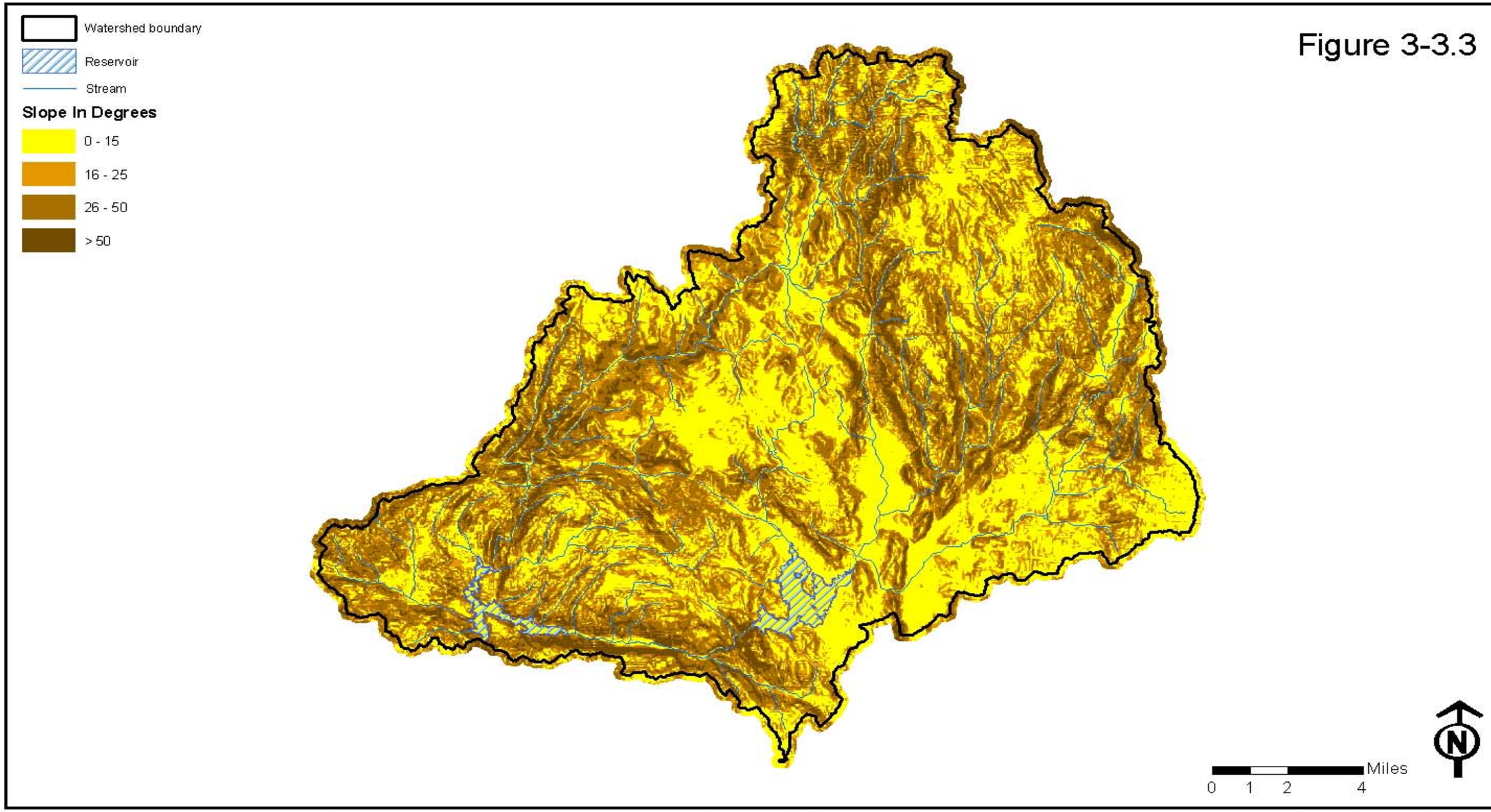
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey2005\Slope\Otay_Dulzura_Watershed_slope.mxd

Created By: Dan Daft
Date: 8/2/05

SanGIS

Cottonwood Watershed SLOPE

Figure 3-3.3



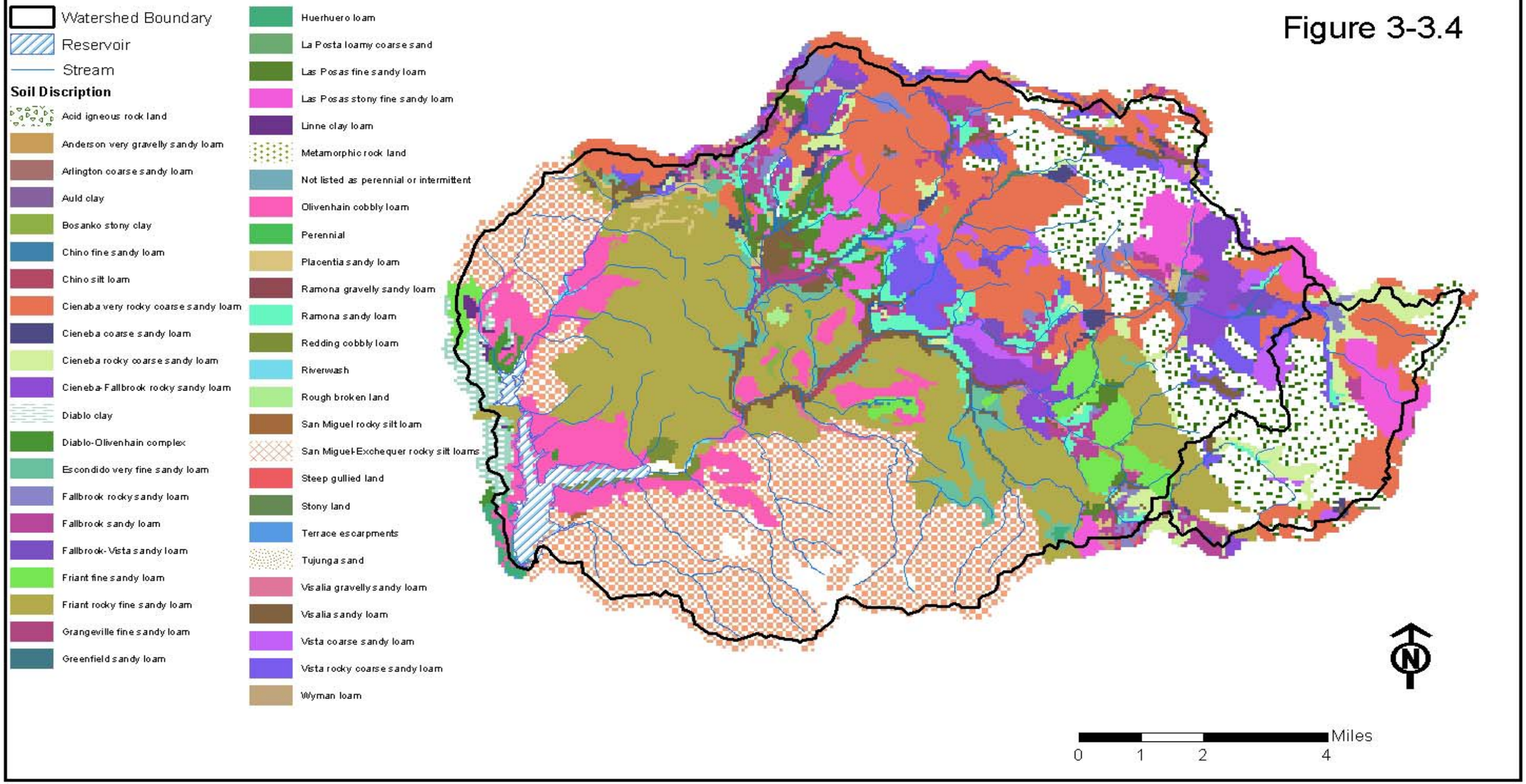
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey 2006\Slope\Cottonwood_watershed_slope.mxd

Created By: Dan Daft
Date: 8/2/05

SanGIS

Otay & Dulzura Watersheds SOILS

Figure 3-3.4



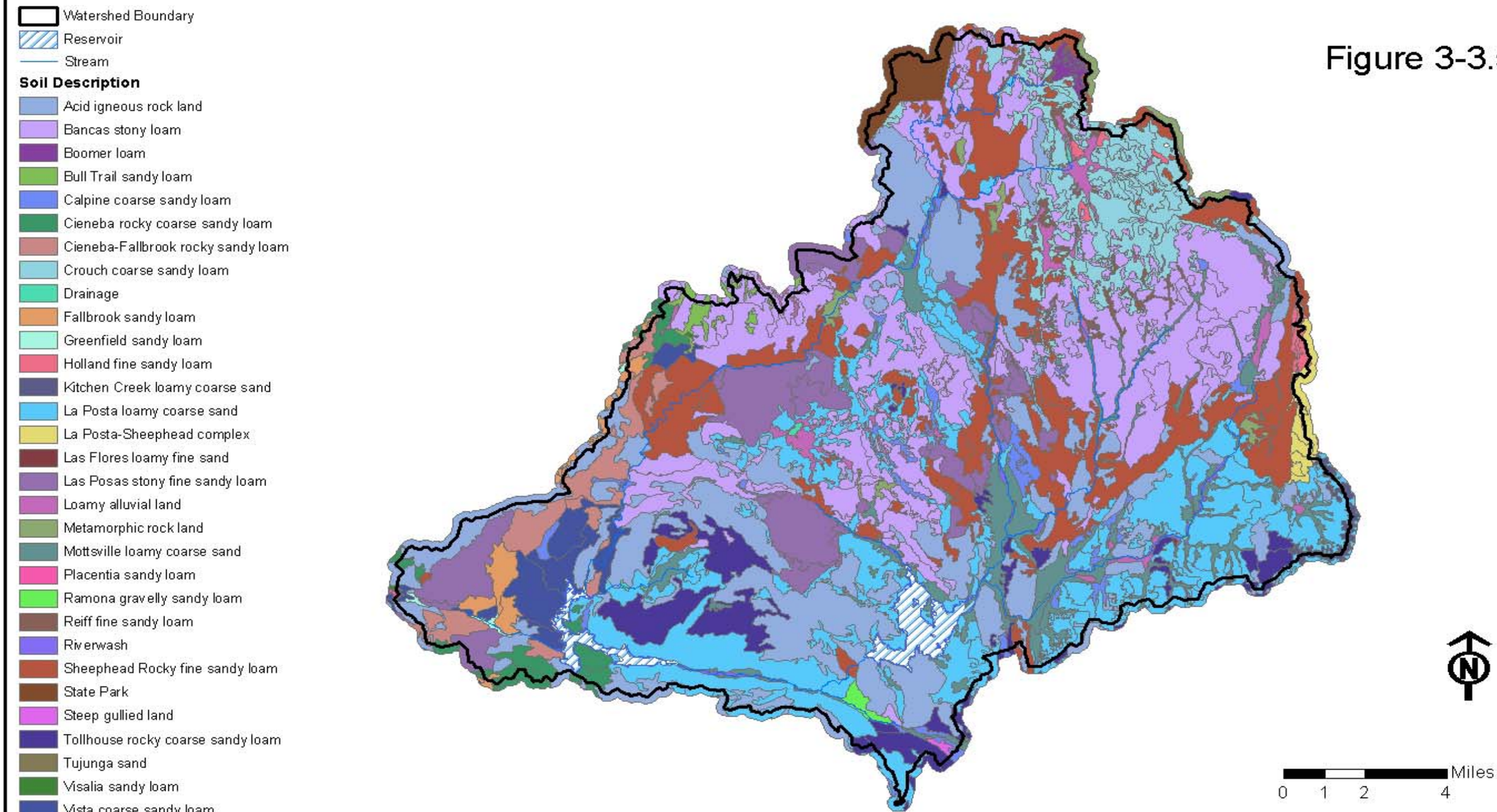
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Soils\Otay & Dulzura Watershed Soils.mxd

Created By: Dennis Brown
Date: 25 August 2005

SanGIS

Cottonwood Watershed SOILS

Figure 3-3.5

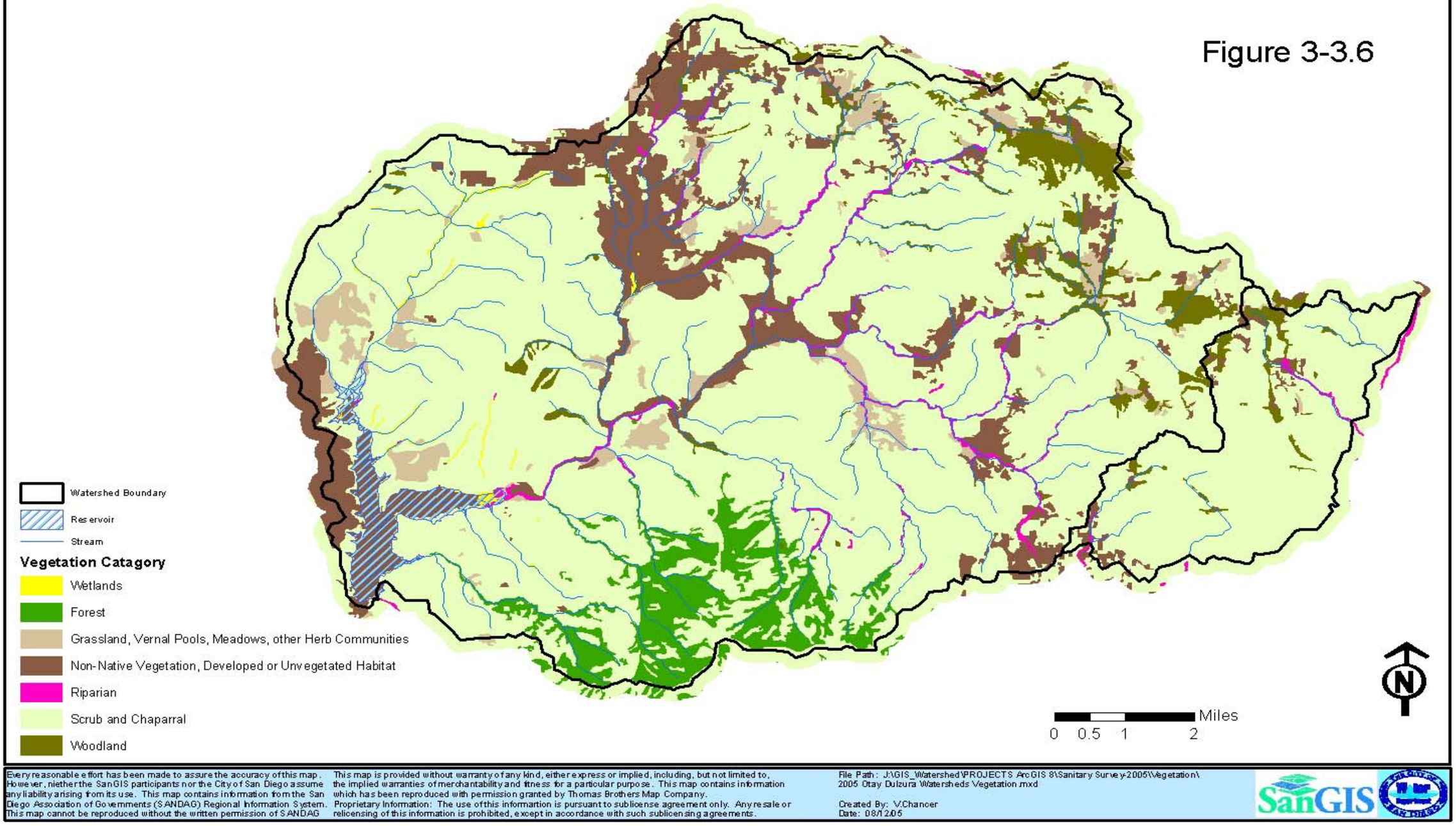


File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Soils\Cottonwood Soils.mxd

Created By: Dennis Brown
Date: 25 August 2005

Otay & Dulzura Watersheds VEGETATION

Figure 3-3.6



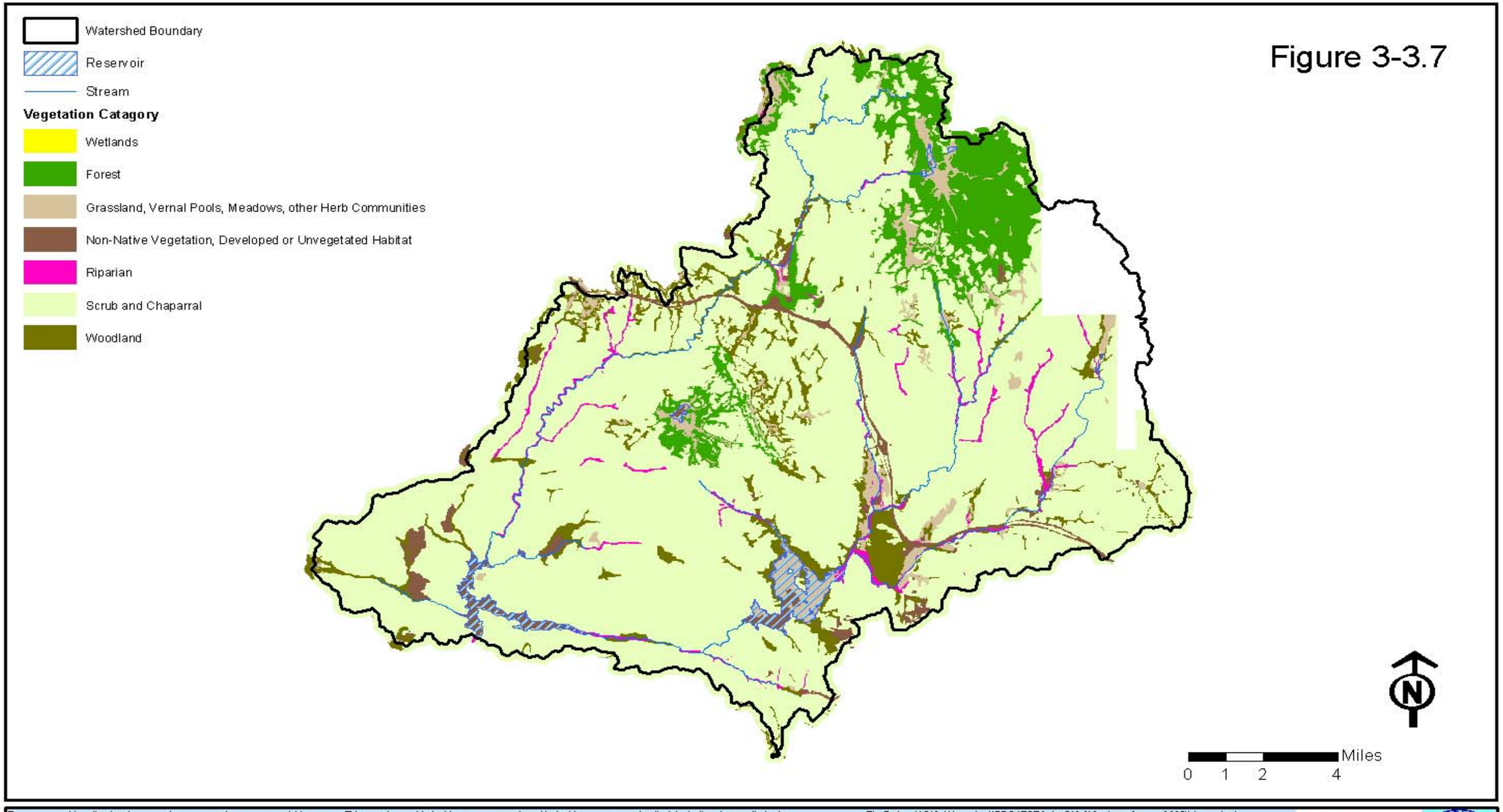
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Vegetation\2005 Otay Dulzura Watersheds Vegetation.mxd

Created By: V.Chancer
Date: 08/1/2005

SanGIS

Cottonwood Watershed VEGETATION

Figure 3-3.7



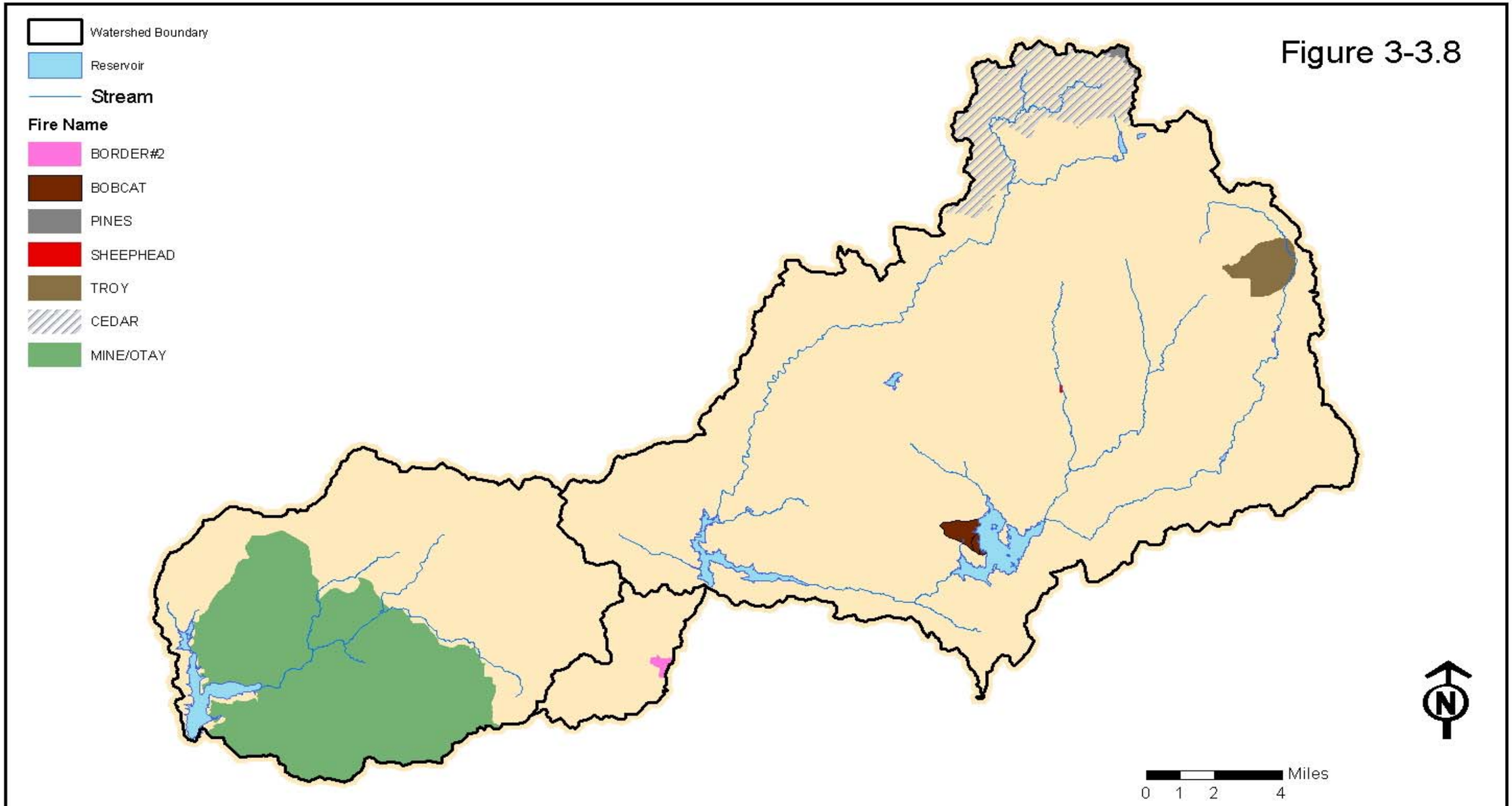
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey 2005\Vegetation\2005 Cottonwood Watershed Vegetation.mxd

Created By: V.Chancer
Date: 08/12/05

SanGIS

Fire Perimeters in the Otay, Dulzua & Cottonwood Watersheds

Figure 3-3.8

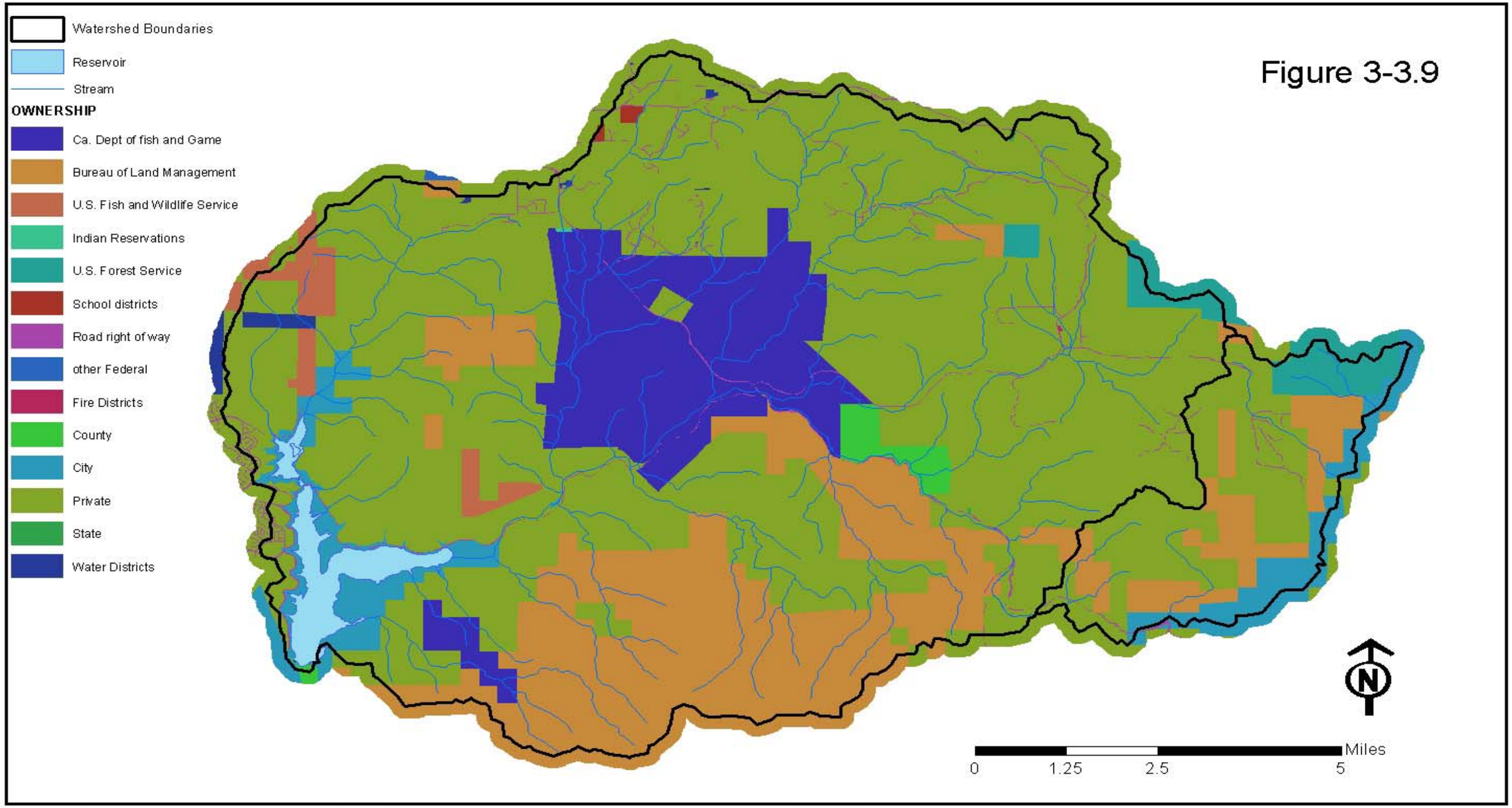


File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Fire\Otay and Cedar Fire Psrimeters in the Cottonwood\Otay Watersheds.mxd
Created By: Dan Daft
Date: 11/21/05

SanGIS

Otay & Dulzura Watersheds LAND OWNERSHIP

Figure 3-3.9

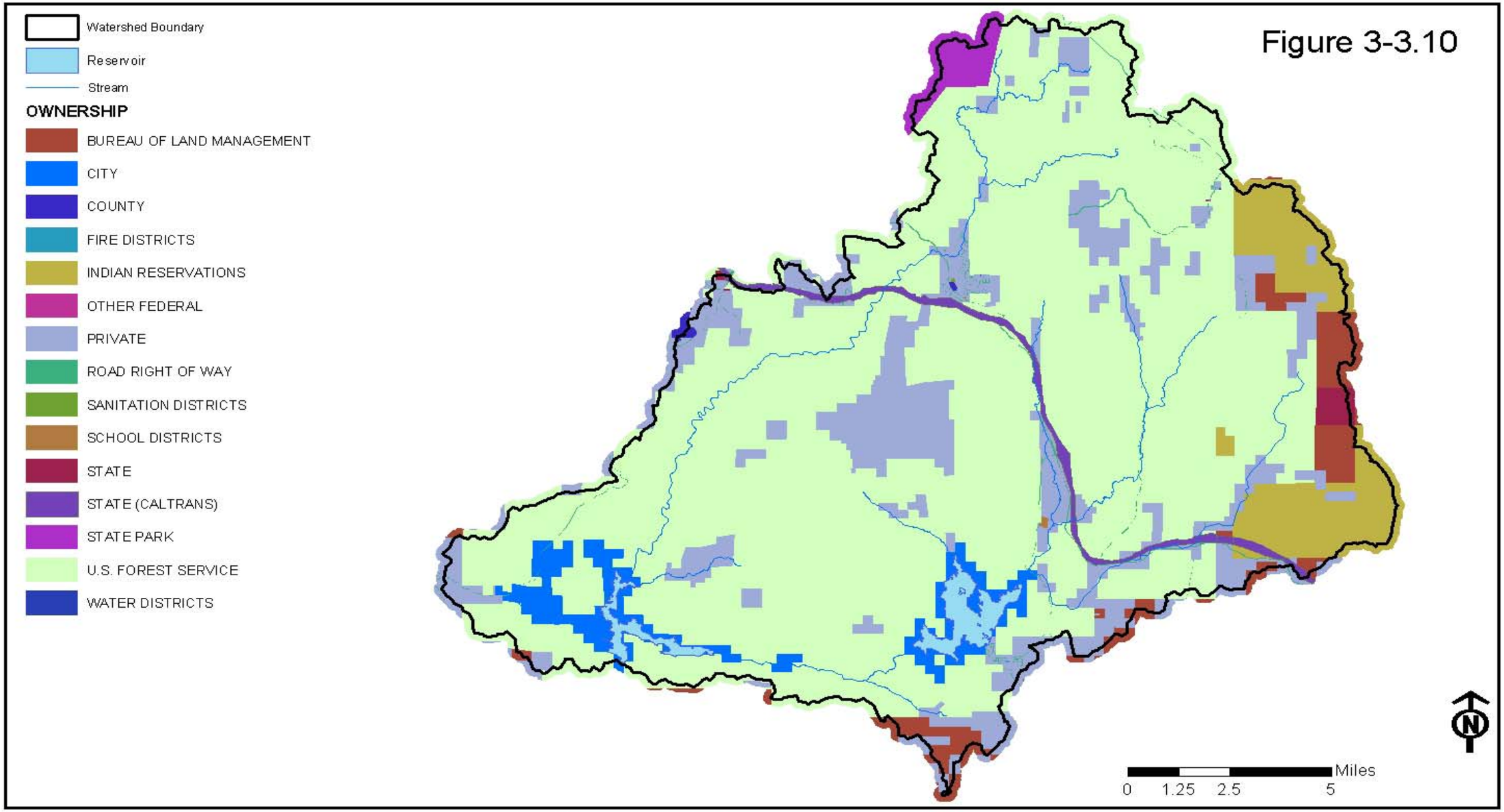


File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey 2005\landuse\Otay\Dulzura watershed Ownership.mxd

Created By: Dennis Brown
Date: January 9, 2006

Cottonwood Watershed LAND OWNERSHIP

Figure 3-3.10



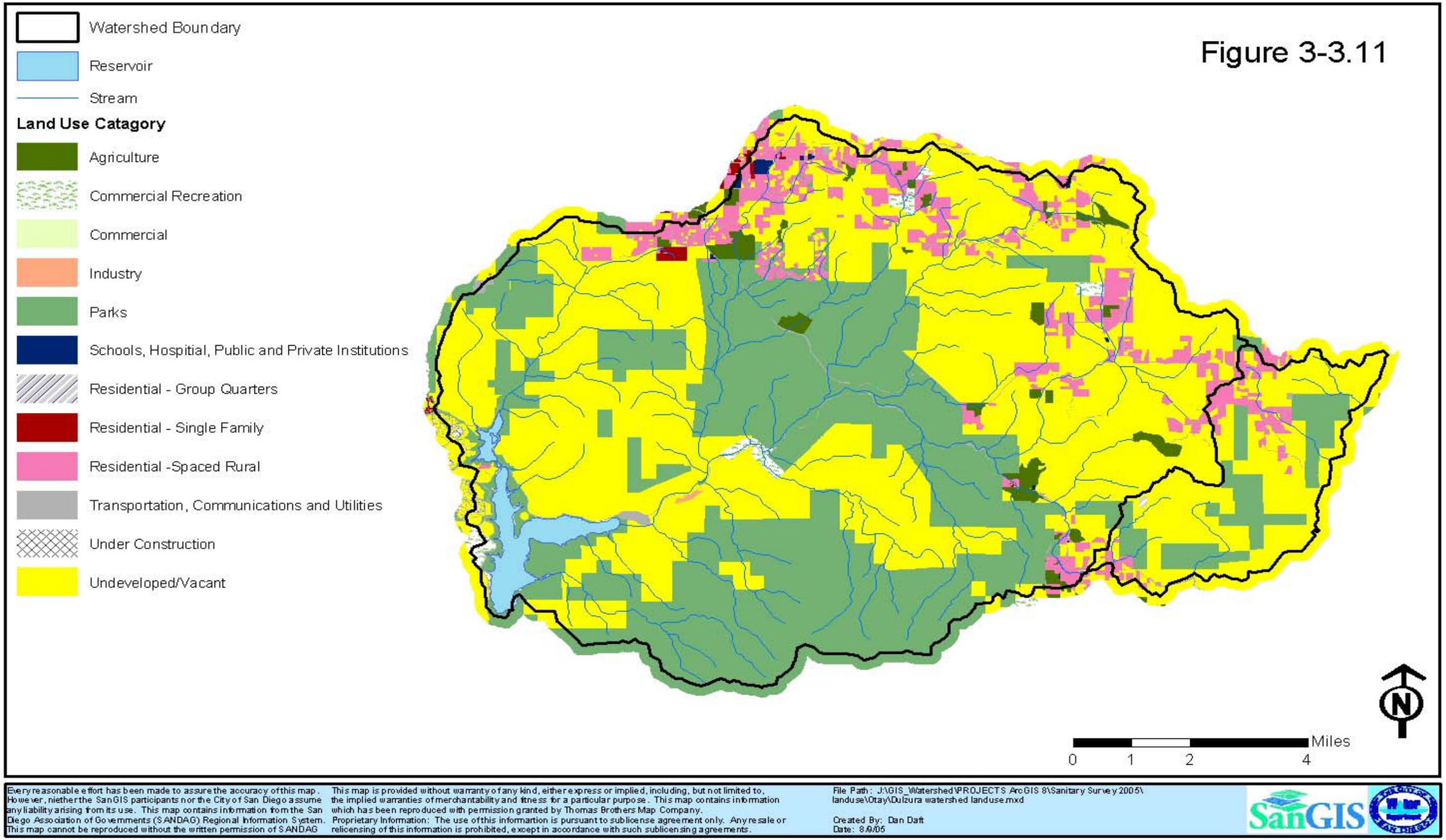
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey 2005\landuse\Cottonwood watershed land ownership.mxd

Created By: Dennis Brown
Date: 04 January 2006

SanGIS

Otay & Dulzura Watersheds LANDUSE

Figure 3-3.11



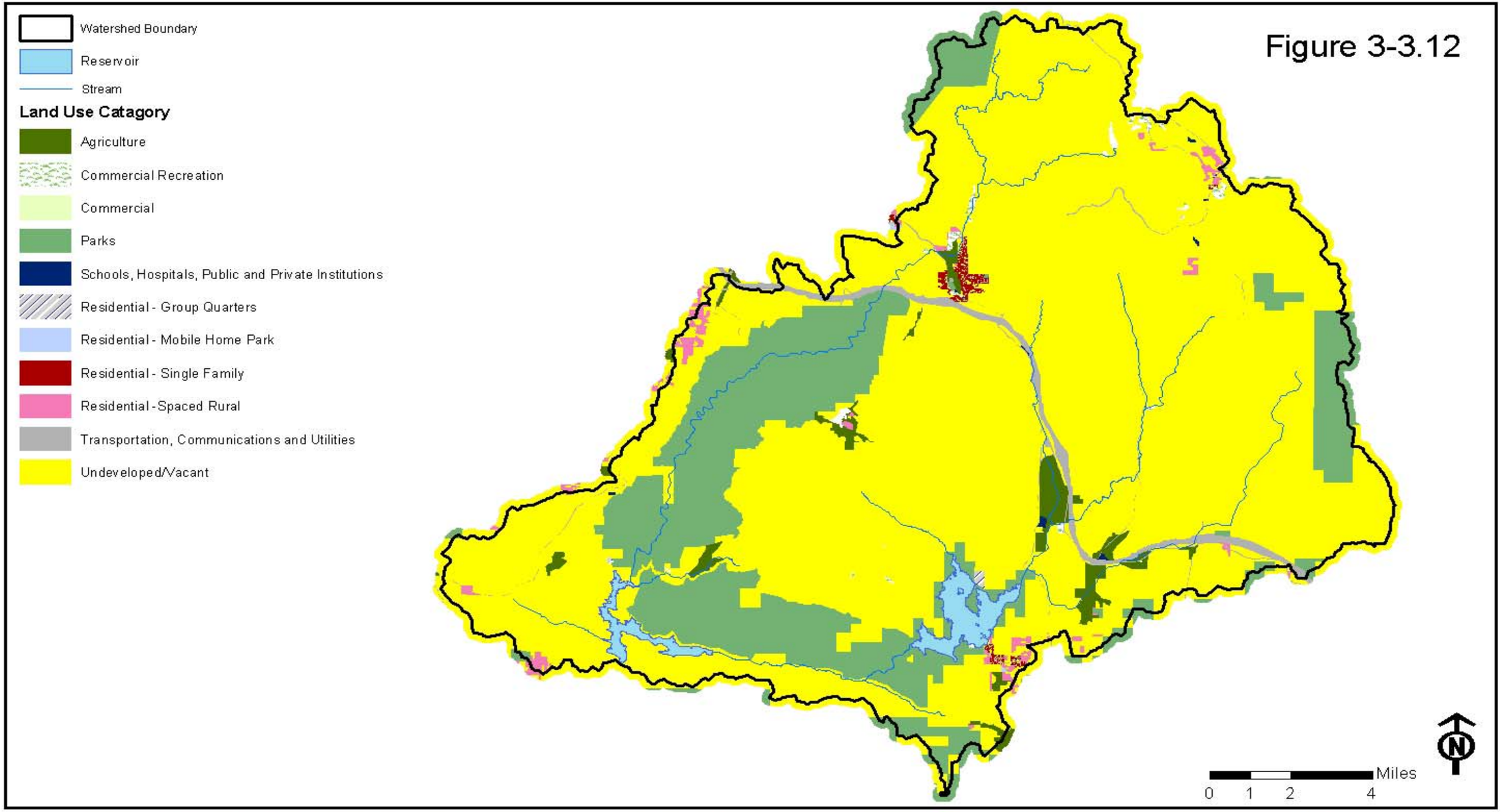
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey 2005\landuse\Otay\Dulzura watershed landuse.mxd

Created By: Dan Datt
Date: 8/9/05

SanGIS

Cottonwood Watershed LANDUSE

Figure 3-3.12



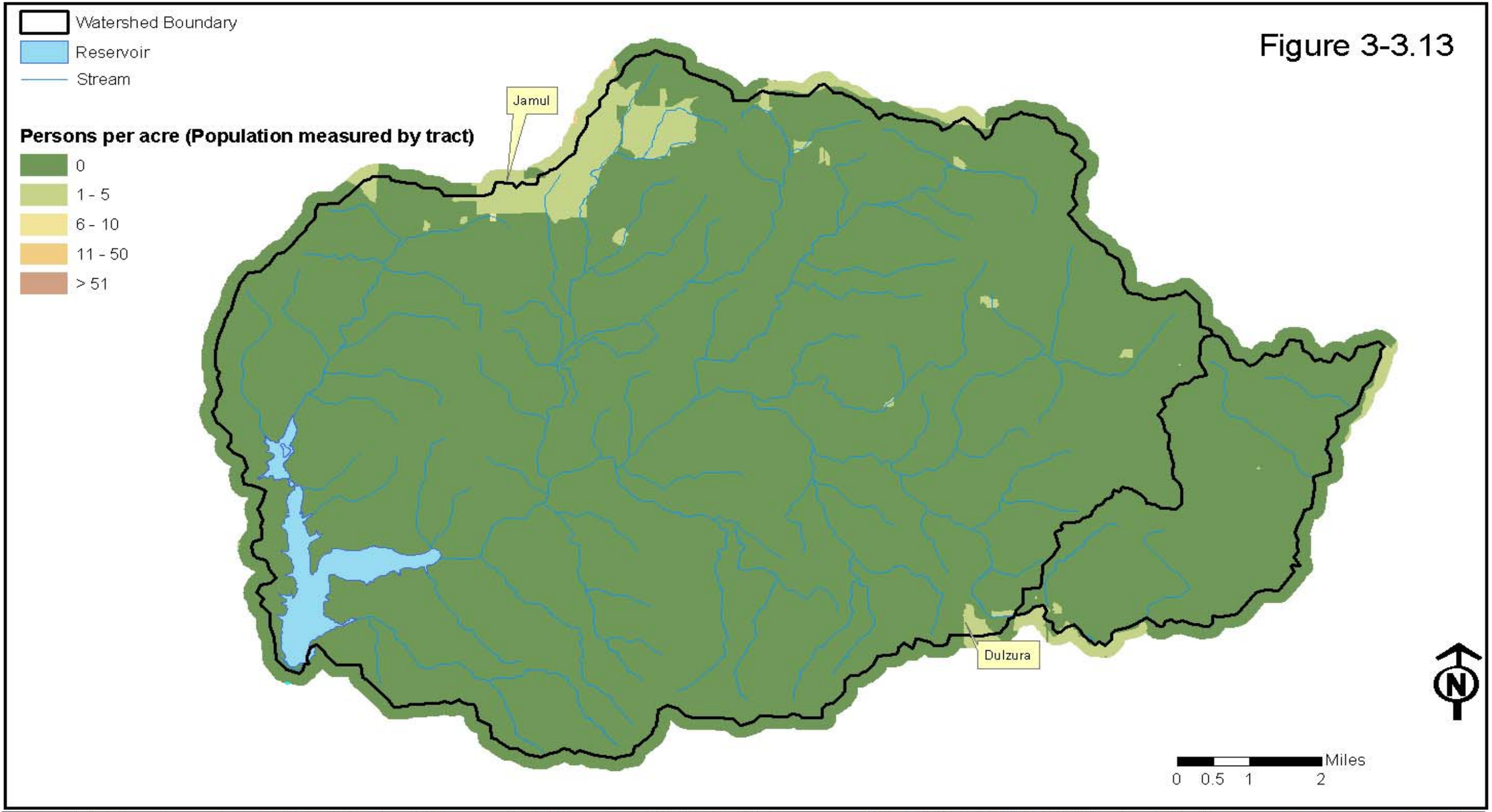
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey 2005\landuse\Cottonwood watershed landuse.mxd

Created By: Dan Daft
Date: 8/9/05

SanGIS

Otay & Dulzura Watersheds POPULATION DENSITY

Figure 3-3.13



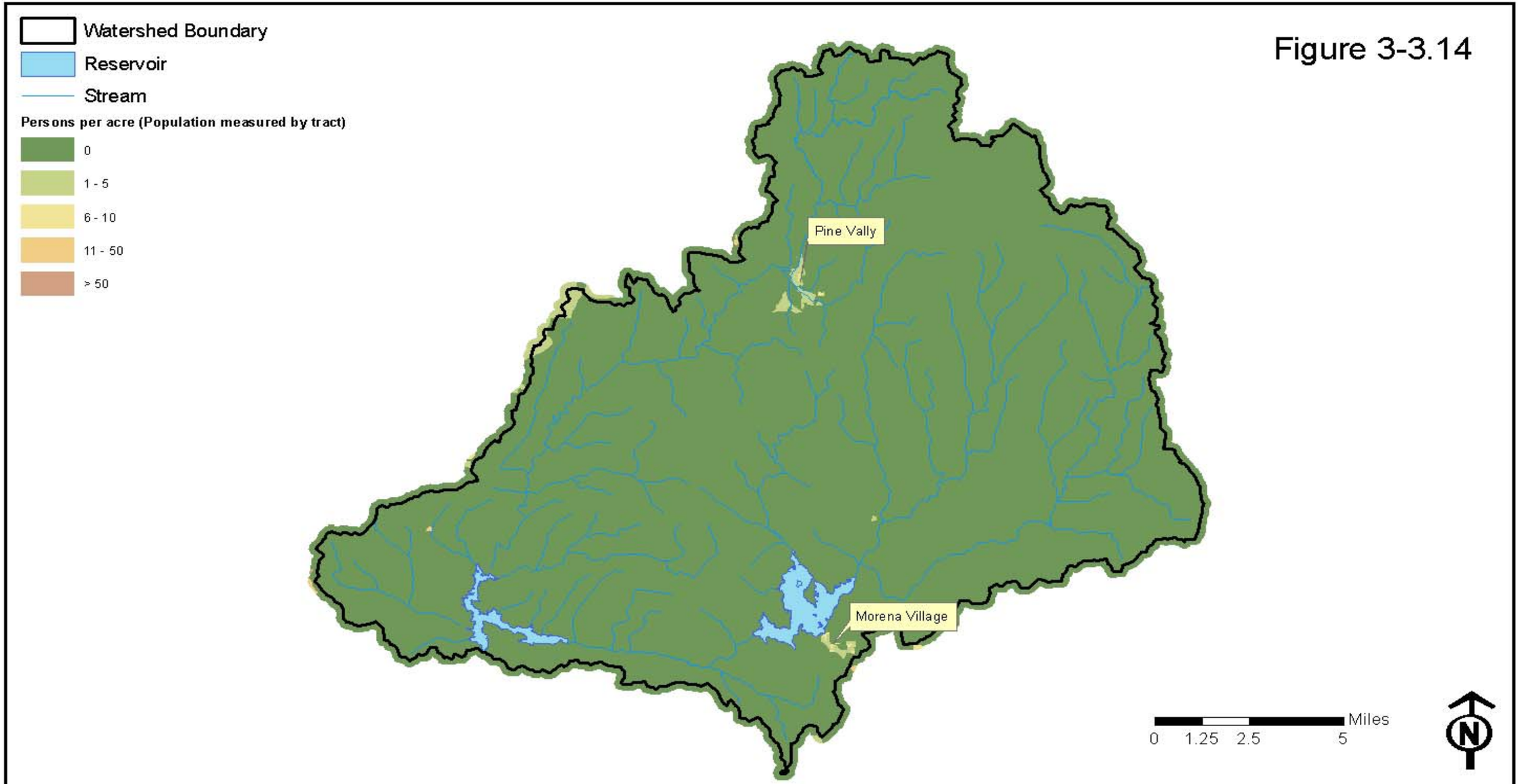
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Population ot dul Pop 05.mxd
Created By: Dennis Brown

Date: 21 December 2005

SanGIS

Cottonwood Watershed POPULATION DENSITY

Figure 3-3.14



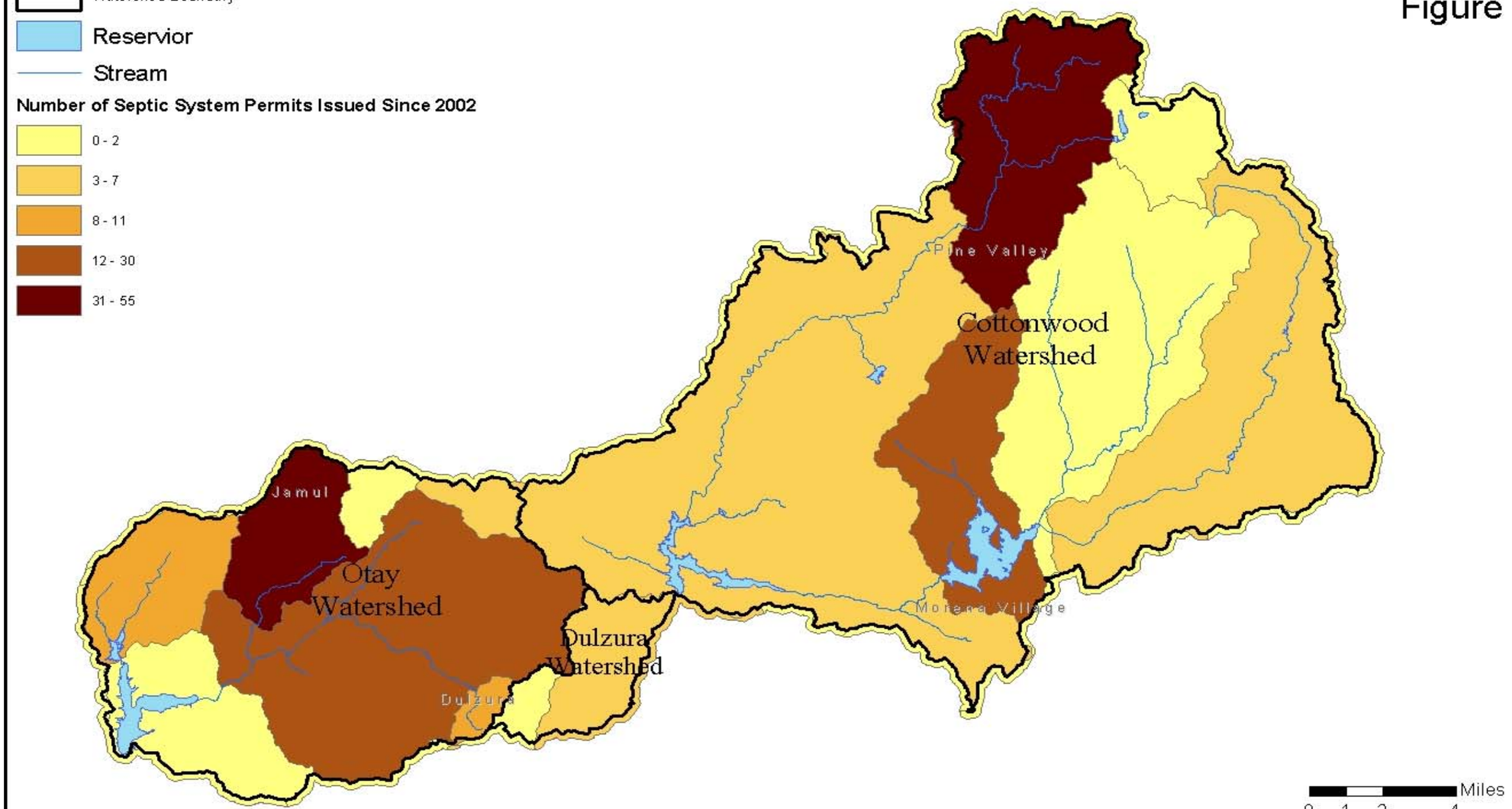
File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Population Cott Pop 05.mxd
Created By: Dennis Brown

Date: 21 December 2005

SanGIS

Septic System Permits in the Otay, Dulzura & Cottonwood Watersheds Since 2002

Figure 3-3.15



File Path: J:\GIS_Watershed\PROJECTS ArcGIS 8\Sanitary Survey-2005\Septic Systems\Cott Dul Ot watershed SS.mxd

Created By: Dan Dat
Date: 11/04/05